AUD002 Carbon Emissions and firm financial performance in JSE Socially Responsible Investment (SRI) index consistent performers

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Abstract

Environmental management has become a critical part of the operations of major firms across the globe. Firms in South Africa are no exception. The need to satisfy stakeholders has led to firms adopting environmentally friendly initiatives such as carbon emissions. This paper explores the impact of these carbon emissions on firm financial performance. Using panel data analysis, the carbon emissions of selected JSE SRI Firms are tested if they impact firm financial performance. Preliminary findings suggest that there is a negative association between carbon emissions and firm financial performance in these firms. Close scrutiny of the integrated financial reports and sustainability reports indicates a moral obligation for the firms to reduce their carbon emissions as well as pressure from authorities. The paper concludes by offering an agenda for further research to bridge the gap in knowledge in this critical area.

Keywords: Carbon Emissions, Firm financial performance, JSE SRI, Panel data analysis, South Africa

Introduction

There are contemporary environmental and ecological problems faced by mining firms within the communities they operate in (Evangelinos and Oku, 2006; Garvin *et al.*, 2009; and Mutti *et al.*, 2011). This has often resulted in corporate reactive measures to settle environmental problems meted to communities or in cleaning the environment (Garvin *et al.*, 2009). However, what is required are proactive Environmental Management Practices (EMP) to curtail the occurrence of environmental problems.

South Africa is one of the emerging economies in which resultant swift growth has been accompanied by severe environmental degradation, leading to illnesses and premature deaths (Shaw, 2012). Mining firms have been critiqued for apparent environmental impact, and corporate environmental neglect has been widely condemned for its negative impact on climate change, for which Brazil, Russia, India, China and South Africa (the BRICS countries) has raised alarms (Shaw, 2012).

In their study, Evangelinos and Oku (2006); Ngwakwe (2009); and Lee (2012) found that the level of corporate apathy towards environmental responsibility is high. Consequently other researchers have engaged in discovering what makes firms to become environmentally responsible (Lee & Hutchinson, 2005; Setthasakko, 2007; Zhang *et al.*, 2008; and Artiach *et al.*, 2010). Amongst others, it is found that financial performance

tend to motivate firms to embark on environmental management (McGuire, *et al.*, 1988; Barnett, 2005; and Artiach *et al.*, 2010); but these studies were conducted overseas. Environmental related research in South African focuses more on disclosure such as (De Villiers & Barnard, 2000; Antonites & De Villiers, 2003; De Villiers, 2003; Hamann, 2004; and Mitchell & Hill, 2010), but none of these earlier studies has looked into the effect of mining firms' carbon emissions and its effect on Return On Equity (ROE) in the Republic of South Africa. This study therefore has become important to fill this gap and in doing so, add to existing literature on Environmental Management Practices and firm financial performance.

Legislative framework

There are many policies, legislative and strategic frameworks governing environmental management in South Africa. South Africa has numerous Acts that affect environmental management and related issues. Some of these Acts in question include:

- The Hazardous Substances Act (Act 5 of 1973)
- The Occupational Health and Safety Act (Act 85 of 1993)
- The South African Constitution (Act 108 of 1996)
- The Municipal Structures Act (Act 117 of 1998)
- The National Environmental Management Act (Act 107 of 1998)
- The National Water Act (Act 36 of 1998)
- The Municipal Systems Act (Act 32 of 2000)
- The Mineral and Petroleum Resources Development Act (Act 28 of 2002)
- The Health Act (Act 63 of 2003)
- The Air Quality Act (Act 39 of 2004)
- The National Environmental Management: Waste Act, 2008 (Act 59 of 2008)

Other appropriate frameworks include the Draft White Paper on Integrated pollution and Waste Management for South Africa issued in 1998. Of relevance to this paper are the South African Constitution (Act 108 of 1996), Draft White Paper on Integrated Pollution and Waste Management for South Africa (1998), National Environmental Management Act (Act 107 of 1998), Mineral and Petroleum Resources Development Act (Act 28 of 2002), Air Quality Act (Act 39 of 2004) and the National Environmental Management Waste Act 59 of 2008 and the National Waste Management Strategy (2011). However, the acts that have a direct bearing on this study are briefly discussed below.

The South African Constitution (Act 108 of 1996)

The supreme law of South Africa, the constitution sets out under the Bill of Rights in subsection 24 that South Africans have a right to an environment that is not detrimental to their health and well-being and that this environment ought to be preserved for current and future generations through legislation and other means.

National Environmental Management Act (South Africa, 1998)

The National Environmental Management Act (NEMA) is the key act that has led to the development of legislation, policies and self-regulatory frameworks regarding environmental management. As stipulated by the constitution in Chapter 2, South Africans have a right to a healthy environment. This Act ensures that they indeed enjoy the right to a healthy environment by promoting environmental management as a means of having a healthy environment (Republic of South Africa, 1998). The act further provides for the creation of environmental management plans, which set out in detail the policies, plans, practices and priorities that an organisation uses as a guideline to maintain and protect the environment from possible degradation (Republic of South Africa, 1998). It also calls for an integrated approach to environmental management, acknowledging that all aspects of the environment are intertwined and that the best possible decisions must be made with regards to evaluating potential environmental choices (Republic of South Africa, 1998). South African mining firms hence use the act to enact their own environmental self-regulation. Together with international benchmarks, this leads them into adopting Environmental Management Practices that are at the heart of this study.

Theoretical framework

The study is anchored on two theories, namely, the Legitimacy theory and the Stakeholder theory. The figure below depicts Legitimacy theory in the context of Environmental Management Practices, particularly carbon emissions:



Figure 1: Legitimacy theory in the context of Environmental Management Practices

Legitimacy theory

This theory states that firms cannot continue to exist and thrive if their thinking and methods are contrary to those of the society in which they operate (Deegan & Rankin, 1996; Wilmshurst & Frost, 2000; O'Donovan, 2002; and Antonites & De Villiers, 2003). According to Suchman (1995:574), legitimacy is defined as "a widely held view that an

organisation's actions are acceptable and done in good faith within a socially constructed system of beliefs, norms, values and definitions." Suchman (1995); Tilling & Tilt (2010); and Mahadeo *et al.*, (2011) argue that legitimacy is viewed as a critical tool that has an inherent value which has to be preserved and maintained to guarantee acceptance and support from stakeholders.

Owen (2008) contends that a major number of studies related to corporate social and environmental reporting have used legitimacy theory as their primary explanatory impetus. Organisations are in an on-going quest to show that their operations are in conformity with society's expectations and norms. High risk organisations whose activities are likely to have an impact on the environment, such as mining and industrial companies, are strong proponents of legitimacy. This enables these firms to have society's acceptance of their activities (LIM, *et al.*, 2010). According to Buhr (1998), organisations and their related accounting systems carry out their activities with an economic, political and social context.

The operations and existence of an organisation is dependent on how the organisation maintains this social contract and may threaten the organisation should the society deem a breach in this contract (Matthews, 1993; and Deegan, 2002). If there is dissatisfaction with how organisations carry out their operations, society can revoke this contract and hamper an organisation's ability to continue existing (Matthews, 1993; and Deegan, 2002). Deegan *et al.* (2002) argued in line with previous authors such as (Gray *et al.*, 1996; Deegan, 2002; Bebbington *et al.*, 2008; and Cho *et al.*, 2012) that legitimacy theory represented the idea of a social contract between an organisation and society. Bebbington *et al.* (2008) and Cho *et al.* (2012) were of the view that organisational managers utilised strategies that showed an organisation's efforts towards conforming within the accepted norms of society.

Deegan *et al.*, (2002) further argued that the relationship between society and organisations was dynamic; thereby requiring organisations to be cognizant of the expectation placed by this implied 'social contract and had to always operate with full responsibility. As a result of increased community scrutiny, cognizance and concern for environmental impacts as a result of organisational operations, legitimacy inclines organisations towards taking the appropriate measures that will ensure that their operations are in line with broader societal views (Ahmad & Sulaiman, 2004).

In their work, Mobus (2005) explored compulsory environmental disclosures in a legitimacy theory perspective and Showed that organisational legitimacy was a much broader concept, within which aspects like environment management contributed to the concept. Mobus (2005) further argued that the concept of legitimacy was more generalised than narrowed down to any particular circumstance and that legitimacy could not be sustained without consistent adherence to specific ideals, norms and values. Once lost, regaining legitimacy is a tedious task on the part of organisations, who may have lost their acceptance and standing in society (Mobus, 2005). Echoing other authors, Magness

(2006) views legitimacy as a social contract existing between communities and organisations; placing the burden on organisations to act in accordance with acceptable norms and ideals. Legitimacy theory argues that managers in organisations use reporting to form an impression on the part and obligation of the organisation to stakeholders (Magness, 2006). Tilling and Tilt (2010) examined the legitimacy theory with regards to CSR reporting in a tobacco firm. They argued that legitimacy as a theory is used to explain corporate behaviour. Given the nature of the industry under study, threats to organisational legitimacy are regarded as high and as a result, the evolving nature of legitimacy as a concept is studied (Tilling & Tilt, 2010).

Legitimacy is a seen as an integral resource to an organisation (Hearit, 1995; and Tilling & Tilt, 2010). Certain activities and actions are closely related to it and have a direct impact on the levels of legitimacy. They can either increase or decrease this resource with direct consequences for an organisation. High legitimacy is good for an organisation, increasing acceptance with society and improved reputation for the organisation. Low levels of legitimacy on the other hand present a danger to the good standing of organisation in the eyes of society and a direct threat to their continued operations (Tilling & Tilt, 2010). Mäkelä and Näsi (2010) linked the concept of social contract to legitimacy. As stated in previous researchers by Matthews (1993) and Deegan (2002), legitimacy was viewed as a social contract between organisation and society, with a weight of expectation placed highly on the organisation to conform to accepted norms and ideals. Mäkelä and Näsi (2010) therefore argued that legitimacy and social contracts were essential for the good standing of organisations in societies.

Legitimacy theory is applicable to this study given that selected mining firms appear to have realised that they cannot operate without attending to the demands of society. Organisational legitimacy is increasingly adopting Environmental Management Practices as a critical component. Perceptions and norms from communities are increasingly taking into account any detrimental actions as a result of an organisation's activities. One way to maintain a social contract that is legitimate is by engaging in voluntary Environmental Management Practices (EMP) (Mobus, 2005). Thus mining firms in South Africa have a duty to legitimise their operations by engaging in Environmental Management Practices such as carbon emission reduction.

Stakeholder theory

According to Mutti *et al.*, (2011), the Stakeholder theory stipulates that firms are obliged to distribute benefits to all stakeholders, rather than to only the shareholders and customers. Elijido-Ten (2007) contends that Stakeholder theory posits that a firm's success is dependent how successfully it manages the relationships that it forms with a variety of stakeholders. Other researchers such as Donaldson and Preston (1995); Jamali *et al.* (2008); and Mahadeo *et al.* (2011) argue that Stakeholder theory posits an alignment of two disparities; an ethical and an instrumental branch. These two branches are relevant in the theoretical framework governing this research. The ever-evolving nature of the business world has led to an increasing need for organisations to acknowledge their

responsibility to a host of stakeholders other than the owners/investors and to provide solutions to problems that may arise due to company activities. This is an area that the Stakeholder theory is applied (Elijido-Ten, 2007).

According to Polonsky (1995), firms must be cognizant of their duty to numerous internal and external stakeholders. They cannot operate without putting the needs of these stakeholders at the forefront. Given the diverse needs of different stakeholders, the theory suggests that firms must take into account these needs and meet the minimal expectations required of them by the stakeholders. In their critique of Stakeholder theory, Key (1999) argued that Stakeholder theory was an all-encompassing model that could be used to explain organisational behaviour. Freeman (1984) saw Stakeholder theory in the form of an actor/environment relationship. He argued that that the actors, both internal and external were directly affected by the operating environment of the firm which resulted in the theory that organisations had to perform to the expectations of all stakeholders rather that the traditional economic approach focussing on shareholders alone (Freeman, 1984; and Key, 1999).

The figure below shows Stakeholder theory in the context of Environmental Management Practices. Based on what is in the above literature, Stakeholder theory can be within two branches; ethical and instrumental branch (Donaldson & Preston, 1995; Jamali *et al.* 2008; and Mahadeo *et al.* 2011). Ethical branch relates to the moral obligations of organisations towards their environment resulting in these Environmental Management Practices. Instrumental branch refers to the role that management has as both custodians of firms' financial performance (equity) and the environment (Environmental Management Practices).





Therefore, the role of stakeholders cannot be ignored in organisational activities. The mining firms are obliged to spend on Environmental Management Practices so as to benefit the local communities in which they operate. Therefore there is a need to show how these Environmental Management Practices impact firm financial performance in the South African mining industry.

Related Literature

Assumptions have been made that Environmental Management Practices (EMP) and firm performance are unrelated and have nothing in common (Slater & Gilbert, 2004). Most of the existing literature on Environmental Management Practices (EMP) has focused on the relationship between corporate sustainability performance, corporate financial performance and the quality of environmental management reports (Al-Tuwaiji *et al.*, 2004). Over the years, different hypotheses have emerged from researchers aimed at addressing the relationship between corporate environmental performance and firm performance. These hypotheses suggest a negative, neutral or positive relationship between the aforementioned variables (Artiach *et al.*, 2010).

One perspective states that there is a negative relationship between the two variables as reported in previous studies (Alexander & Bucholz, 1978; Aupperle, *et al.*, 1985; McGuire *et al.*, 1988; Barnett, 2005; Becchetti, *et al.*, 2005; Cho & Paton, 2007; and Artiach *et al.*, 2010). A common reason found to cause such a negative relationship is the costs involved in adopting more environmentally friendly practices which results in resource distribution away from investors to external stakeholders such as local communities (Aupperle *et al.*, 1985; McGuire *et al.*, 1988; Barnett, 2005; and Artiach *et al.*, 2010).

Another view suggests that Environmental Management Practices (EMP) and firm performance have no association (Ullmann, 1985; and Artiach *et al.*, 2010). The argument raised here is that this relationship is difficult to ascertain due to the possibilities of numerous intervening influences which pose a challenge for control. This, coupled with inadequate theoretical support, was deemed to be too much for anyone to expect a relationship between Environmental Management Practices and firm performance (Artiach et al., 2010). A more recent suggestion to explain the lack of relationship found in previous studies is failure on the part of early researchers to control for firm size and industry (Paten, 2002; and De Villiers & Van Staden, 2011). However, contrary to these negative findings, other researchers maintain that Environmental Management Practices and firm performance are positively associated (Alexander & Bucholz, 1978; Waddock & Graves, 1997; Al-Tuwaiji *et al.*, 2004; Barnett, 2005; Clarkson, *et al.*, 2006; Clarkson *et al.*, 2008; and Artiach *et al.*, 2010).

Previous research findings identify various factors in determining a positive relationship between Environmental Management Practices and firm performance. Thus, some find that the financial rewards of engaging in Environmental Management Practices outweigh the costs involved in the long run (McGuire *et al.*, 1988; and Barnett, 2005) and investing in Environmental Management Practices may result in improved relationships with stakeholders such as local communities, lenders and governments. Similarly, other findings hold that environmental management investment results in improved firm performance by managing stakeholders (Artiach *et al.*, 2010). Another perspective, also known as the resource view, suggests that firms that invest in Environmental Management Practices experience increased resources (Alexander & Bucholz, 1978; Waddock & Graves, 1997; Clarkson *et al.*, 2006; and Artiach et al., 2010). Montabon *et al.* (2007) examined the relationship between Environmental Management Practices and firm performance. They established that a significant and positive relationship exists between Environmental Management Practices and measures of firm performance.

Montabon *et al.* (2007) also examined the impact of carbon emissions on firm financial performance. They found a significant relationship between carbon emissions and firm financial performance. A comprehensive study on the impact of waste management and carbon emissions on firm financial performance was carried out by Iwata and Okada (2011). They examined this relationship in Japanese manufacturing firms for a five-year period. Using Return On Equity (ROE) as one of the measures of firm financial performance was not statistically significant. On the other hand, Iwata and Okada (2011) also studied the impact of carbon emissions on firm financial performance. They employed Return On Equity as one of their measures of firm financial performance and discovered that carbon emission reductions increase long-run firm financial performance.

Hart and Ahuja (1996) studied the relationship between emissions reduction and firm financial performance. They found that, using Return On Equity as one of their variables, a relationship between emissions reduction and Return On Equity could only be partially confirmed. Soyka and Powers (2002) studied the effects of energy efficiency on corporate profitability performance. They found evidence suggesting that energy efficient strategies create remarkable new corporate wealth. They also discovered that investments in energy saving programs by firms used in their study resulted in statistically significant positive impacts on their operating margins. In their work, Delmas and Nairn-Birch (2010) examined the impact of greenhouse gas emissions (GHG) on firm financial performance. Interestingly, their findings indicated that increasing carbon emissions resulted in a positive impact on firm financial performance when employing accounting based measures of financial performance, while the same linkage was negative when using market based measures of firm financial performance.

In their study, Busch and Hoffmann (2011) examined the linkage between carbon emissions and carbon management strategies and corporate financial performance. They found that when using carbon emissions as outcome-based measurement, the relationship between carbon emissions and corporate financial performance was positive. However, when they used carbon management strategies as a process based measure, it resulted in a negative association between their corporate environmental performance and financial performance. Davidsdottir and Fisher (2011) examined the link between carbon emissions and economic performance in the United States. Using panel analysis, they examined any

link between the two variables, focusing on the direction of causality between the two. They discovered that a two-directional significant relationship did exist between carbon emissions and economic performance. Davidsdottir and Fisher (2011) concluded that their findings made it possible for States to introduce sector-unique policies that could reduce energy and carbon emissions intensity and improve fiscal performance at the same time.

Yu et al. (2009) studied the greenness strides by European based firms from a resource efficiency perspective. Their aim was to determine whether or not a link existed between environmental effects and financial performance. Yu et al. (2009) also attempted to examine if firms that showed more drive towards environmental management showed a more impactful positive relationship between environmental performance and financial performance that those that showed a lesser drive. Using correlation analysis as their methodology, Yu et al. (2009) found that no positive association existed between environmental performance and firm financial performance. They concluded that those European based companies that had superior green efforts did not have any financial rewards to show for their efforts. Yang et al. (2011) studied the impact of lean manufacturing and environmental management on business performance. Within this study, Environmental Management Practices were measured against market and financial performance and Yang et al. (2011) discovered that a negative relationship existed between the two variables. Salama (2005) used regression analysis to measure the impact of environmental performance on financial performance. The findings showed that a positive relationship existed between environmental performance and firm financial performance.

Klassen and McLaughlin (1996) proposed a theoretical model aimed at establishing a linkage between strong environmental management and improved future financial performance. Using empirical methods, Klassen and McLaughlin (1996) discovered that significant positive financial returns were measured for strong environmental management while significant negative financial returns were measured for weak environmental management. Horváthová (2010) argued that the inconclusiveness of results regarding the impact of environmental performance on financial performance was due to underlying factors, such as industry uniqueness and firm size. The results of her study showed that the probability of obtaining a negative association between Environmental Management Practices and financial performance drastically increases when using correlation coefficients while the use of panel data techniques and multiple regressions had a neutral effect on the outcomes.

King and Lenox (2001) investigated whether or not a causal relationship existed between firm's Environmental Management Practices and firm financial performance. The main thrust of their study was to test whether other underlying firm attributes had a direct effect on this relationship. Applying empirical methods, King and Lenox (2001) discovered that a link existed between a measure of Environmental Management Practices and firm financial performance, but failed to illustrate the direction of this linkage. Wingard and Vorster (2001) performed an in-depth examination on the financial performance of

environmentally responsible South African listed companies. Using correlation analysis, they argued that a positive relationship existed between the environmental responsibility and financial performance of South African listed companies. On the other hand, in their study, Oberholzer and Prinsloo (2011) used GHG emission, water usage and energy usage as environmental variables and found that gold-mining firms did not realise economic gain from efficient use of their environmental variables.

Methodology

This paper made use of mixed methods to test for any impact of carbon emissions on firm financial performance. Mixed methods are a method of research that employs both quantitative and qualitative methods (Buslera, 2013 & Creswell, 2013). Quantitative data analysis made use of the Panel OLS method. Panel least squares is a method useful for cross sectional time-series data (Baltagi, 2001; Nerlove, 2002; Arellano, 2003; Frees, 2004; Hsiao, 2007; Westerlund & Basher, 2007 & Mark & Sul, 2012). A qualitative review of integrated and sustainability reports of the participating firms was also used in an attempt to establish any linkage between carbon emissions and firm financial performance.

Population and sample

This paper studied mining firms listed on the JSE Socially Responsible Index (SRI). These firms were selected due to their high ranking in terms of triple bottom line reporting. The best performers for the time period 2007 to 2011 were chosen as a sample for the study. This time frame allowed for a comparable set of data to be drawn and used in this study. The firms used in the study are AAC, AGA, AM, EXX, GF, IMP, KUM, LON & MER respectively.

Data collection

In this study, the data used was obtained from the firms' annual integrated reports and sustainability reports. These are found in public domain on the companies' websites. Pseudonyms were used as a means to ensure commercial confidentiality of the firms.

The variables represented were; carbon emissions (CE) and firm financial performance represented by return on equity (ROE). Return on equity was the dependent variable while carbon emissions represented the independent variable. The data used in the analysis is shown in table one below. This data was sourced from the annual integrated reports and sustainability reports of the companies under study.

Obs	ROE	СЕ	
AAC - 07	33.6	25.40	
AAC - 08	28.1	19.80	
AAC – 09	10.4 18.90		
AAC - 10	21.4	20.00	
AAC – 11	11.3	18.80	
AGA – 07	-26.0	4.51	
AGA – 08	-45.9	4.55	
AGA – 09	-8.6	4.79	
AGA – 10	3.1	4.82	
AGA – 11	30.9	4.51	
AM – 07	26.2	2.56	
AM – 08	39.0	2.61	
AM – 09	-1.8	2.65	
AM – 10	6.2	4.44	
AM – 11	-0.2	4.49	
EXX – 07	15.0	1.50	
EXX – 08	30.0	1.80	
EXX – 09	19.0	2.30	
EXX – 10	34.0	2.20	
EXX – 11	36.0	2.10	
GF – 07	7.1	5.20	
GF – 08	11.3	5.10	
GF – 09	4.3	4.90	
GF – 10	4.4	5.40	
GF – 11	16.0	5.20	
Imp – 07	52.3	3.10	
Imp – 08	37.9	3.20	
Imp – 09	13.9	3.40	
Imp – 10	11.5	3.80	
Imp – 11	15.2	4.00	
Kum – 07	118.4	5.00	
Kum – 08	106.8	5.50	
Kum – 09	98.4	6.80	
Kum – 10	99.5	8.00	
Kum – 11	108.3	0.91	
Lon – 07	17.3	1.63	
Lon – 08	21.8	1.61	
Lon – 09	11.5	1.60	
Lon – 10	3.9	1.59	
Lon – 11	9.6	1.61	
Mer – 07	16.7	1.90	
Mer – 08	41.5	3.10	
Mer – 09	6.5	2.20	
Mer – 10	10.8	3.00	
Mer – 11	4.4	2.30	

Table 1: Data showing carbon emissions and return on equity

Analysis and discussion

The quantitative data analysis used panel data ordinary least squares (OLS) method to test for any relationship between carbon emissions and firm financial performance. The adjusted R squared had to be interpreted with confidence levels set at 95%. This meant that the adjusted R squared had to be lower than 5% to show any significant link between carbon emissions and firm financial performance. Table two shows the descriptive statistics of the data used in the study.

	ROE	СЕ
Mean	24.68889	5.395111
Median	15.20000	3.800000
Maximum	118.4000	25.40000
Minimum	-45.90000	0.910000
Std. Dev.	33.81822	5.706024
Skewness	1.293449	2.251570
Kurtosis	4.764866	6.953510
Jarque-Bera	18.38773	67.32846
Probability	0.000102	0.000000
Sum	1111.000	242.7800
Sum Sq. Dev.	50321.56	1432.583
Observations	45	45

Table 2: Descriptive statistics of the variables

The panel data analysis presented the following results depicted in table three below Dependent Variable: ROE Method: Panel Least Squares Date: 10/02/15 Time: 16:47 Sample: 2007 2011 Periods included: 5 Cross-sections included: 9 Total panel (balanced) observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CE C	0.155351 23.85076	0.903511 7.053318	0.171941 3.381494	0.8643 0.0015
R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood F-statistic Prob(F-statistic)	0.000687 -0.022553 34.19744 50286.99 -221.7761 0.029564 0.864291	Mean depe S.D. depen Akaike info Schwarz cr Hannan-Qu Durbin-Wa	ndent var dent var o criterion iterion unn criter. itson stat	24.68889 33.81822 9.945605 10.02590 9.975539 0.221491

Table 3: Panel data results

From the table above, it can be seen that the adjusted R squared is -0.022553. Interpreting the adjusted R squared is mentioned in Data and statistical services (2013) and University of Texas (2013). The data above shows that there is a negative association between carbon emissions and firm financial performance represented by return on equity, consistent with the findings of Barnett (2005) and Artiach *et. al.* (2010). A possible reason for these findings could be other variables that may affect firm financial performance such as firm size.

A qualitative review of the firms' integrated and sustainability reports showed that all firms reported on their carbon emissions to conform to current international trends. Close scrutiny of the annual integrated and sustainability reports suggests that the need to conform to stakeholder expectations as well as pressure from authorities has resulted in the firms reducing their carbon emissions. This is evident across all the firms under the study. Financial motives were mentioned in five firms as reasons for carbon emission reductions. This was in done in order to reduce potential financial costs owing to uncontrolled emissions.

Conclusions, limitations and recommendations

This study attempted to explore if there was any link between carbon emissions reduction and firm financial performance in selected JSE SRI listed mining firms. Panel data analysis and qualitative review of company reports was used. It was discovered that there is a negative link between carbon emissions reduction and firm financial performance represented by return on equity. However, moral obligations and pressure from authorities were the reasons behind the carbon reduction, instead of potential financial benefits. The number of firms studied constituted only a small proportion of the total number of mining firms currently operating in South Africa. As such, the results of the study cannot be generalised across the entire mining industry in South Africa.

As the world continues to drive towards development, it will be necessary for further study in this field to determine the factors that drive environmental management. Areas for further research may include examining other environmental management practices such as energy efficiency and water efficiency. This will help bridge the gap in knowledge currently existing. The government must provide incentives for all firms that are operating in a green way. This will also provide impetus for firms to operate in an environmentally sustainable manner and preserve the fragile environment that we all live in.

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